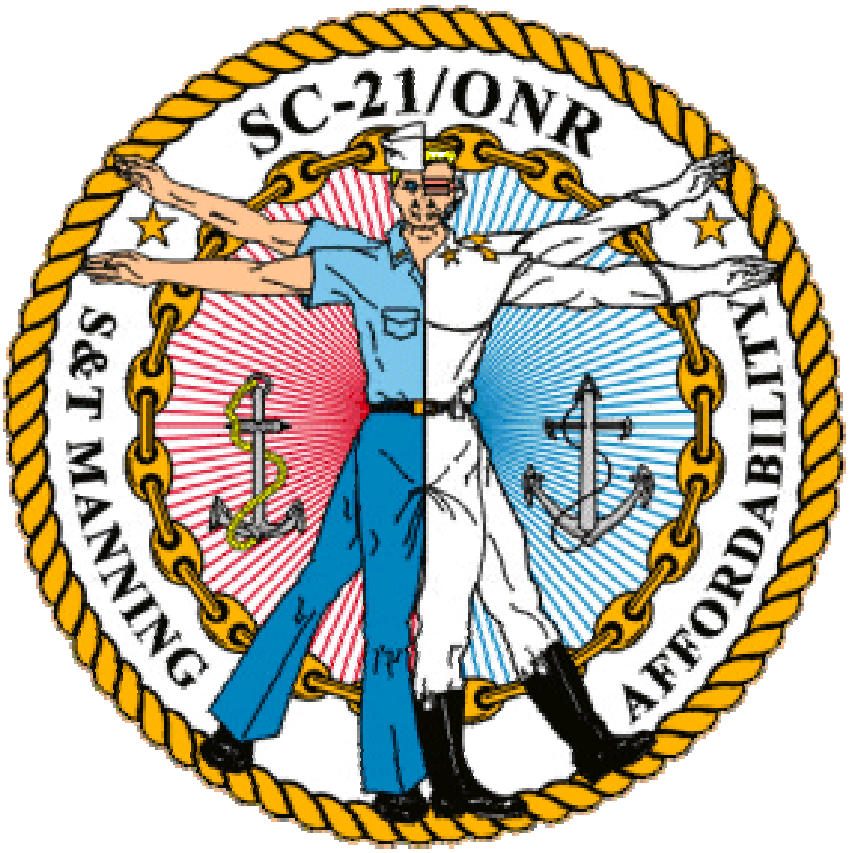
# Human Engineering Process Tools List




## DD 21/ONR

## SC-21 S&T Manning Affordability Initiative

**September 1998**

*The following tools have been identified as applicable to different stages of the human engineering process. Tools designated with an "(HW)" are applicable only to design stages where a hardware version of the system is available, whether as a prototype, mockup, or other physical simulation. This document was prepared as a service to the SC-21 Science and Technology Manning Affordability Initiative. Neither the United States Government nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial products, process, or service by trade name, trademark manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government. The opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government, and shall not be used for advertising or product endorsement purposes.*

*The information present, including tool capabilities, descriptions, and points of contact, was collected from company product literature, previous surveys, tool developers or vendors, or other methods of research. Inclusion or exclusion of particular tools does not imply endorsement or rejection of an individual tool. This document is simply a list of currently available tools in support of Human Engineering and Human Factors. Suitable tools other than those listed may be available.*

| Page | Tool Name | Acronym Meaning | Mission Analysis | Requirements Analysis | Function Analysis | Function Allocation | Design | Verification |
|---|---|---|---|---|---|---|---|---|
| 6 | ACT (HW) | Activity Catalog Tool | | | | | X | X |
| 6 | ADIVA (HW) | All-Digital Integrated Video Analysis | | | | | X | X |
| 7 | ALPHA/Sim | | | | | | X | X |
| 7 | AMCOS | Army Military-Civilian Cost System | | X | | X | | |
| 7 | Anthropometric Data Set | | | X | | | X | X |
| 8 | ASSESS | | | | | X | | |
| 8 | CASA | Cost Analysis Strategy Assessment | | | | X | X | X |
| 8 | CASHE:PVS | Computer-Aided Systems Human Engineering: | | X | | X | X | X |

| Page | Tool Name | Acronym Meaning | Mission Analysis | Requirements Analysis | Function Analysis | Function Allocation | Design | Verification |
|---|---|---|---|---|---|---|---|---|
| | | Performance Visualization System | | | | | | |
| 9 | CDE | Cockpit Design Editor | | | | | X | X |
| 9 | Cheman | Chemical Man | | | | | X | X |
| 10 | COMBIMAN | Computerized Biomechanical Man-model | | | | | X | X |
| 11 | ComputerMan | | | | | | X | X |
| 11 | CREW CHIEF | | | | | | X | X |
| 12 | CTT | Critical Tracking Task | | | | | X | X |
| 12 | CUTTER | Carlow Usability Test Tool for Evaluation and Research | | | | | | X |
| 13 | DEPTH | Design Evaluation for Personnel, Training, and Human Factors | | | | | X | X |
| 13 | Destination | | | | | X | X | |
| 14 | Display Visibility Modeling | | | | | | X | |
| 14 | DYNAMAN | | | | | | X | X |
| 15 | EDCAS | Equipment Designer's Cost Analysis System | | X | | X | X | X |
| 15 | EMS | Engineering Modeling System | | | | | X | X |
| 15 | ENVISION/ERGO | | | | | | X | X |
| 16 | EPIC | Executive Process-Interactive Control | | | | | X | X |
| 17 | HOMER | | | | X | X | X | X |
| 17 | HOS V | Human Operator Simulator | | | X | X | X | X |
| 17 | HT-1166 | SHIPSHAPE Hypertext Tool for ASTM-F-1166 | | X | | | | X |
| 18 | HT-1472 | IDEA Hypertext Tool for MIL-STD-1472 | | X | | | | X |
| 18 | Human Scale | | | | | | X | X |
| 19 | I-CAN | IDEA/SHIPSHAPE Comparability Analysis | | | | X | | |
| 19 | iGEN | COGnition as a Network of Tasks/Generator of Interface | X | X | X | X | X | |
| 20 | I-HEDGE | IDEA/SHIPSHAPE Human Factors Engineering Data Guide | | | | | X | X |

| Page | Tool Name | Acronym Meaning | Mission Analysis | Requirements Analysis | Function Analysis | Function Allocation | Design | Verification |
|---|---|---|---|---|---|---|---|---|
| | | for Evaluation | | | | | | |
| 20 | IMAGE | Integrated Mission Analysis and Scenario Generation | X | X | X | | | |
| 20 | IMPACT | Integrated Manpower Analysis and Conceptualization Tool | X | X | | X | X | X |
| 21 | IMPRINT | Improved Performance Research Integration Tool | X | X | X | X | X | |
| 21 | INDI | Integrated Non-Development Items | | | | | X | X |
| 21 | INJURY 5.0 | | | | | | X | X |
| 22 | IPME | Integrated Performance Modeling Environment | X | X | X | X | X | |
| 22 | I-SHADE | IDEA/SHIPSHAPE Safety Hazard Analyzer, Developer, and Evaluator | | X | | | | X |
| 23 | ITALIC | IDEA/SHIPSHAPE Tradeoff Analysis | | X | | | | |
| 23 | I-TASK | Integrated Task Analysis | | | | | X | |
| 24 | JOSTE | Joint Operating and Support Technology Evaluation | | X | | X | X | X |
| 24 | KOALAS | Knowledgeable Operator Analysis-Linked Advisory System | | X | | | | |
| 24 | LCOM | Logistics Composite Model | | X | | | X | |
| 25 | LMT | Logistics Modeling Tool | | | | | X | |
| 25 | MacSHAPA (HW) | | | X | X | X | X | X |
| 26 | MDHMS | McDonnell Douglas Human Modeling System | | | | | X | X |
| 26 | Micro Saint | | | | X | X | X | X |
| 27 | MIDAS | Man-Machine Integration Design and Analysis Systems | | X | | X | X | |
| 27 | MPT DSS | Manpower, Personnel and Training in Acquisition Decision Support System | | X | | X | X | X |
| 28 | NASA-TLX (HW) | NASA Task Load Index | | | | | X | X |
| 29 | Network | IDEA/SHIPSHAPE Task Sequencing | | | X | X | X | |
| 29 | OASYS | Operability Assessment System | | | X | X | X | X |
| 30 | Observer (HW) | | | | | | X | X |
| 30 | ORCA | Operational Requirements-Based Casualty Assessment | | | | | X | X |

| Page | Tool Name | Acronym Meaning | Mission Analysis | Requirements Analysis | Function Analysis | Function Allocation | Design | Verification |
|---|---|---|---|---|---|---|---|---|
| | | System | | | | | | |
| 31 | OWLKNEST (HW) | Operator Workload Knowledge-Based Expert System Technology | | | | | X | X |
| 31 | PATS/WAM (HW) | Psychophysiological Assessment Test System | | | | | X | |
| 32 | PRICE HL | Programmed Review of Information for Costing and Evaluation for Hardware Life cycle cost | | X | | X | X | X |
| 32 | RECAP | | | X | | | | |
| 32 | ROMAN | Roles of Humans & Automation | | | | X | | |
| 32 | ROPER | IDEA/SHIPSHAPE Role of the Person | | | | X | | |
| 32 | SAFEWORK | | | | | | X | X |
| 32 | SHIP-SHAPE | Ship System Human Systems Integration for Affordability and Performance Engineering | X | X | X | X | X | X |
| 33 | SIMWAM | IDEA/SHIPSHAPE Simulation for Workload Assessment and Modeling | | | | X | X | |
| 33 | SNAP (HW) | Simulation Network Analysis Project | | | | | X | X |
| 35 | SORD | Systematic Organizational Design | | X | | | | |
| 35 | STRES (HW) | AGARD Standardized Tests for Research with Environmental Stressors | | | | | X | X |
| 36 | SWAT (HW) | Subjective Workload Assessment Technique | | | | | X | X |
| 37 | TAWL | Task Analysis Workload | | | | | X | |
| 37 | TEMAP (HW) | User-Assisted Test and Evaluation Methodology Assistant Program | | | | | | X |
| 37 | Transom Jack | | | | | | X | X |
| 38 | TSIInterchange | | X | X | X | X | X | X |
| 38 | USARIEM Heat Strain Model | | | | | | X | X |
| 39 | WC FIELDE (HW) | Workload Consultant for Field Evaluations | | | | | X | |
| 39 | WINCREW | | X | X | X | X | X | X |

## ACT (Activity Catalog Tool)

ACT provides instant, real-time statistical analysis of an observed sequence, including such measures as frequency of occurrence, duration of activity, time between occurrences and probabilities of transitions between activities. ACT automatically creates a data-log file that provides a detailed description of all observations, as well as a further important statistical description of the concurrence of events and activities. To allow for multiple observers and/or multiple observations of a given video tape, data-log files can be merged and/or appended using simple post processing functions.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/act.htm

## ADIVA (All-Digital Integrated Video Analysis) System

ADIVA is a completely digital test data analysis and reporting system. It is completely COTS; has a complete graphical user interface (GUI), online and hard copy documentation, automatic installation and a tutorial with sample video and data files. ADIVA fuses video, numerical and event analysis data into a single environment. The integrated ADIVA desktop allows the user to publish results as text reports, data files and fully edited videos. The technology is useful in analysis of video and data from simulators, missions, test stands, machinery, human activities and animal activities. ADIVA was originally designed for human factors analysis and has been used to study communications, tactile operations, usability, ergonomics, and training session debrief.

Point(s) of Contact:
POC: J. Scott Carpenter
Phone: 408-353-4916
E-mail: scott@c3dgraphix.com

## ALPHA/Sim

ALPHA/Sim is a flexible, general-purpose, discrete-event simulation tool that may be applied to areas such as computer and communications networks, plant layout and automation, parallel and concurrent system design and military systems. It can provide timing and sizing specifications for system design as well as throughput and failure analysis, workload analysis and queuing analysis. The objects flowing through the system are represented by

tokens. Icons may be transferred from a palette to define the model's logical structure. The user may define timing parameters, queue disciplines and branching rules based on probability, priority or expression evaluation.

Point(s) of Contact:
E-mail: alpha.sim@alphatech.com
Information: http://www.alphatech.com/alpha.htm

**AMCOS (Army Military-Civilian Cost System)**

Manpower cost models are used to forecast the life cycle of a new or proposed weapon system by year for each Military Occupational Specialty (MOS), as well as for the entire system. The user can compute cost elements, such as military compensation, recruiting, training and medical support for each MOS. The model will generate costs for the life cycle of the system.

Point(s) of Contact:
POC: George Michael, USACEAC
Phone: 703-681-3335
E-mail: michag@hqda.army.mil
Information: http://www.asafm.army.mil/amcos/amcosweb/demo/fram.htm

**Anthropometric Data Set**

Accounting for human variability in equipment design can be a difficult task. The CSERIAC anthropometry data files offer designers and engineers data useful for resolving human accommodation issues during equipment design. The CSERIAC anthropometric data files are a collection of civilian and military surveys spanning over fifty years of research. Formerly archived by the Air Force Armstrong Laboratory Human Engineering Division Center for Anthropometric Research Data, CSERIAC has now made this database available for general use.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/cada/cada.htm

**ASSESS**

ASSESS is an HSI tool that can be used to assess each alternative role of the human/automation and ship/system concept with respect to affordability,

risk, reliability, effectiveness, readiness, personnel performance, satisfaction and safety. Required inputs are technology development requirements for cost elements, manning, training, skills, RAM (Reliability, Availability, Maintainability), mission effectiveness data and readiness data. Products and outputs include impact of system concept (technology requirements) on affordability, risk, human performance, reliability, workload and safety.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

**CASA (Cost Analysis Strategy Assessment**)

CASA computes LCC for systems, subsystems, and components of subsystems for basic operating scenarios. CASA uses standard LCC and logistics equations for the computation of costs and resource requirements. It uses Monte Carlo Simulation. Logistics elements covered include facilities, manpower and personnel, supply support, technical data, maintenance planning, packaging-handling-storage-transportation, support equipment, and training-training support. Logistics elements NOT covered include computer resource support and design interface. It does not include sub-component breakouts. CASA is the “most widely used Life Cycle Cost model in DoD and Defense Industry” according to the program manager.

Point(s) of Contact:
none

**CASHE:PVS (Computer-Aided Systems Human Engineering: Performance Visualization System)**

CASHE:PVS allows users to explore and experience a multitude of topics concerning human performance in complex systems. CASHE:PVS uses a new and innovative approach to presenting human perceptual and performance data. In CASHE:PVS, text, figures and tables are augmented with simulations, animation and audio to provide a unique and rich understanding of human perceptual and performance phenomena and how they relate to the design of new products. The package features internal links with databases such as the Engineering Data Compendium and MIL-STD-1472D, performance data visualization through the Perception and Performance Prototyper (P3) and Data Digitizer, as well as user annotations with bookmarks, notes, and custom hyperlinks, history trails and session files to save context, settings and results.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/cashe/cashe.htm

## CDE (Cockpit Design Editor)

The CDE is a graphical prototyping and animation environment to design cockpit panel instruments. This tool contains both 2-D and 3-D elements and can be used to render both the page content and logic of multi-function displays, as well as place controls and instruments into an overall crew station layout. The CDE can accept 3-D geometry input from traditional mechanical CAD packages through converters. The surfaces can then be populated with instruments designed within the CDE and used for stand-alone animation or as part of the output display of a comprehensive MIDAS simulation. The CDE is designed to be extremely flexible for building the instruments because all instrument images and animation methods are supported through external libraries. There are no built-in primitives in the CDE. However, it allows a user to map any external instrument image onto any 3-D polygon. The instrument libraries are expandable through a C-language interface.

Point(s) of Contact:
POC: Sherman Tyler
E-mail: MIDAS@qmgate.arc.nasa.gov
Information:
http://ccf.arc.nasa.gov/af/aff/midas/www/Cockpit_Design_Editor.html

## Cheman (Chemical Man)

Chemical Man is a model that may be used to simulate nerve agent exposure effects on five indices of human physiological function: vision, mental, cardio-respiratory, visceral and limbs for five routes of agent entry. The simulation assumes that the agent transfer into the blood plasma occurs by mechanisms which can be described in terms of a first-order equation. A dysfunction index for each of the five indices based on agent blood plasma concentration will be established for each agent. Model results are presented in numerical and graphical form and as an image display with color changes corresponding to changes in dysfunction index as a function of time for each physiological function. The physiological dysfunction will be used to determine soldier performance degradation based on military occupational specialty (MOS) requirements.

Point(s) of Contact:
POC: Dr. Raymond Tytus
Phone: 410-671-4891
E-mail: rptytus@arl.mil

## COMBIMAN (Computerized Biomechanical Man-model)

The COMBIMAN system of programs is a collection of empirical models based on years of research data. This characteristic distinguishes it from human-computer models that are mostly illustrative, rather than analytical. COMBIMAN allows the designer to perform operability analyses and correct design defects while the system is still in the early design stage. As a tool that represents geometric and physical properties of an operator, it can be used to evaluate both existing and conceptual work stations. Since the human-model (in variable body sizes) and the work station can be displayed together on a CRT, alternative designs may be thoroughly evaluated ithout the delays and expense of building and modifying mock-ups. The evaluated designs may then be permanently recorded by a hard copy plot, a listing of the crew station and human-model data or by saving them to the CAD data bases. As an interactive computer-graphics human factors evaluation instrument, this three-dimensional modeling system creates a computerized human-model having correct body size and proportions of Air Force and Army pilots with the encumbrance of clothing and personal protective equipment. COMBIMAN easily allows analysis of visual accessibility, strength for operating controls, reach capability with the arms and legs and fit limitations/capabilities. The designer may place the human-model into a drawing and analyze the interaction between the model's physical capabilities and the design elements related to a specific work station.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/combiman.html

## ComputerMan

The ComputerMan Model is a software tool (written in C++) used for studying the effects of penetrating injuries to personnel. This model is designed to simulate the wounding process and to predict injury outcomes in terms of performance degradation and survivability. Currently, ComputerMan is being used in weapons assessment studies as well as in vulnerability assessments. It can be used to establish the wounding power of fragments in weapons effectiveness studies and to address vulnerability issues such as the

effectiveness of body armor. It is simple to use and utilizes a complex human anatomy model and expert medical knowledge.

Point(s) of Contact:
None

## CREW CHIEF

The CREW CHIEF system of programs is a collection of empirical models based on years of research data. This characteristic distinguishes it from human-computer models which are mostly illustrative, rather than analytical. CREW CHIEF provides designers with a tool for early identification of design-related maintainability problems by analyzing the interaction of a maintenance technician's physical capabilities with the design elements related to specific maintenance tasks. CREW CHIEF is interfaced directly with a CAD database, allowing the designer to evaluate three ergonomic areas against drawings in that CAD database. Physical accessibility is affected by body size, posture, clothing, tool size, adjacent or interfering components and the task performed (such as lift, push, pull or reach). Strength involves the technician's physical ability (which is a function of gender, posture and task performed) to apply a specified torque and/or to lift, position, carry or remove an object. Visibility is the technician's field of view relative to his/her posture, location of the object and components that may obscure the work area. A maintainability problem may involve combinations of these three human factors. For example, a lack of visibility may aggravate a physical accessibility problem by making it more difficult to properly align and position a tool in a restricted working area.
Current military standards establish guidelines regarding placement of components for accessibility. These are based on such factors as item size, frequency of maintenance and/or failure and criticality to system operation. Although the CREW CHIEF system of programs will not resolve the designer's dilemma in such areas, its ability to analyze alternative designs in the interest of maintainability can provide valuable data for design decisions.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/chief.htm

## CTT (Critical Tracking Task)

The CTT is a dynamic tracking task with inherently unstable plan dynamics. The controller must provide some input to maintain the closed-loop stability of the system. The plant dynamics of the task contain a difficulty factor,

lambda, which is variable and adjustable under several program control options. Lambda determines the system's momentary instability and thus controls tracking task difficulty. There are two display modes from which to choose - compensatory and pursuit. The value of lambda at which the operator loses control has been shown to be a reliable measure of operator skill for that particular set of task parameters. This allows for the CTT to be a useful tool in several situations. In a dual-task scenario, the CTT can be used as a loading task, a secondary task or a primary task. The CTT can be used to classify an operator's psychomotor skills. The CTT software can also drive external displays and provide a method of evaluating alternative display information formats.

Point(s) of Contact:
POC: Dr. Richard Dunn
Phone: 301-342-6076
E-mail: dunn@setd-ctl.nawcad.navy.mil

## CUTTER (Carlow Usability Test Tool for Evaluation and Research)

The Carlow Usability Test Tool for Evaluation and Research (CUTTER) is written in Hypercard for the Apple Macintosh computer and offers three modules to support all phases of usability testing. These modules are: 1) a test preparation and planning support module; 2) a data-logging and data analysis module; and 3) an interface evaluation guideline module. The test preparation and planning support module assists in the development of usability test plans and data collection forms. The data-logging and analysis module helps in the collection of task performance data and time-on-task data. During data collection, test personnel observe subjects and enter single keystrokes that begin time- and task-logging for each task in the taxonomy. The interface evaluation module allows the usability engineer to search a library of over 1,000 user interface guidelines, and apply any subset of them to any computer interface under evaluation. CUTTER may be used in usability test planning or conduction, report generation or application of UCI standards to interface under development or test. Its potential outputs include task-activity logs, descriptive statistics, reports, objective measures of human performance using the device tested, subjective (user) measures, identified interface design improvements, usability predictions, inputs to user documentation, customer support plans and training requirements.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

## DEPTH (Design Evaluation for Personnel, Training, and Human Factors)

Developed under contract to Hughes Missile Systems Company, DEPTH allows maintenance activity to be analyzed using articulated, three-dimensional human figure models (HFMs). The HFMs, provided by the Transom Jack software, are accurate representations of humans with respect to both anthropometry (body size and shape) and motion. The HFMs can be proportioned to represent different percentiles within Air Force, Army or civilian populations; dress for arctic, chemical defense or normal environments; and work with any of the 200+ tools in the database. Movement of the HFMs can be controlled with a standard mouse, body tracking equipment or the automatic simulation capability. The automatic simulation capability (referred to as motion modeling) allows complex simulations to be rapidly created. As simulations run, DEPTH reports information such as accessibility, visibility and strength. The information can also be directed to logistics databases.

Point(s) of Contact:
Information: http://www.brooks.af.mil/HSC/products/doc42.html

## Destination

Destination provides a top-level optimization management framework for assessing a design in terms of multi-dimensional design factors to address design trade-offs. It is integrated with MultiView and other tools to provide a design optimization. It enables the user to select design factors/performance metrics to be optimized, and then assists the user in selecting available tools to perform design analysis.

Point(s) of Contact:
None

## Display Visibility Modeling

This tool is a component of MIDAS and it represents the projection onto the cockpit model of the sensory capabilities of the human visual system when considered as a detector filter system. It enables crewstation design engineers to perform basic visibility assessments of potential cockpit designs while the designs are in prototype form. This type of model will aid in selecting the appropriate locations for visual characteristics instruments, controls, windows, visors and sun shields during the conceptual design phase. The output will allow the designer to visualize the effects of

illumination, pilot adaptation, afterimages, head position and point of regard on the appearance of the instruments as seen by the pilot. Such outputs will aid the crewstation designer in understanding the consequences of their choices for the location, size and characteristics of cockpit instruments and controls from a human engineering standpoint.

Point(s) of Contact:
POC: Barry R Smith
Phone: 415-604-4264

**DYNAMAN**

DYNAMAN is a complete software simulation package for the prediction of human body dynamics during aircraft ejection, aircraft crashes, automobile accidents and other hazardous events. Because of its capability to predict the motion and forces on the human body, manikins, seats and other structures, the DYNAMAN model has broad applications in the automobile, aerospace and other transportation systems communities. It is used in the Air Force to determine the safety of restraint systems, seats, escape systems, controls and displays and other equipment in the aircraft cockpit before prototypes are built or costly tests conducted. It is also used to provide data that cannot be measured during a test, such as forces within the body, and to supplement test data with parameter variation simulations. The input requirements for a simulation include a description of the human or dummy body, the environment, the driving motion or force and the initial conditions. The body data can be obtained using a preprocessing module based on Generator of Body Data (GEBOD), which calculates the required data for adult males, adult females, children or testing dummies.

Point(s) of Contact:
POC: Dr. Louise A Obergefell
Phone: 513-255-3665
E-mail: lobergef@tweety.al.wpafb.af.mil

**EDCAS (Equipment Designer's Cost Analysis System)**

EDCAS is a very fast sequential model that is easy to use. It contains a minimum of data entry fields per repairable item, provides excellent support, has over 10 years in use throughout the world, and is applicable for Design-to-LCC in front-end design analysis. It is widely accepted, with over 400 Government and Industry users worldwide.

EDCAS provides information concerning hardware/software LCC; design-to-LCC; spares optimization; reliability; level of repair; manpower, personnel, and training costs; maintainability; and operational availability.

Point(s) of Contact:
None

## EMS (Engineering Modeling System) Software

Intergraph's EMS is high-performance, computer-aided design software for mechanical designers, engineers and drafters. EMS automates the mechanical design process with sophisticated solid modeling and drafting productivity tools. EMS integrates the crew into the conceptual design of existing and future combat, tactical and special-purpose vehicles which meet current and long-range requirements of the Army. The EMS software may be used to determine whether or not there is sufficient crew space, all controls are accessible and the protection levels for the crew are sufficient.

Point(s) of Contact:
POC: Steven Patterson, Army Tank Automotive Command
Phone: 810-574-8600
Information: http://www.ingr.com/mech/ems/ems.htm

## ENVISION/ERGO

ERGO is an “add-on” to Deneb’s ENVISION modeling, simulation, and analysis tool. The ENVISION line of products includes virtual reality, virtual prototyping, and simulation-based design and training. ERGO performs simulation-based physical human modeling for the workplace. It enables the evaluation and improvement of both workspace layout and physical tasks for operation and maintenance. ERGO permits the evaluation of time requirements of physical tasks, working postures, metabolic capacities of workers, and task injury potential. ERGO also includes collision detection, physical task sequence optimization, reach and accessibility analyses, and field-of-view analysis. ERGO and ENVISION have been used in analysis of operational scenarios or maintainability studies for CVX by JJMA, for SC-21 by JJMA, George Sharpe, and Rosenblatt & Sons, and by both the Boeing and Lockheed Martin JSF teams.

Point(s) of Contact:
POC: Scott Freedman, Bob Brown
Phone: (215)741-0804 – Scott Freedman
(248)267-9696 – Bob Brown

E-mail: brown@deneb.com
Information: http://www.deneb.com

**EPIC (Executive Process-Interactive Control)**

EPIC provides a framework for constructing models of human-system interaction that are accurate and detailed enough to be useful for practical design purposes. EPIC represents a synthesis of results on human perceptual/motor performance, cognitive modeling techniques and task analysis methodology implemented in the form of computer simulation software. Visual, auditory and tactile perceptual processors receive inputs from simulated physical sensors. The output of these processors is sent to the working memory of the cognitive processor. The cognitive processor consists of working memory, long-term memory, production memory and a multi-match, multi-fire production rule interpreter (or production system) called PPS. The cognitive processor, on receiving input from the perceptual processors, performs the cognition necessary for the task being modeled. It then sends output commands to the ocular, vocal and manual motor processors.

Point(s) of Contact:
POC: Dr. David E. Kieras
Phone: 313-763-6985
E-mail: kieras@eecs.umich.edu
Information: http://ai.eecs.umich.edu/people/kieras/epic.html

**HOMER**

HOMER is an expert system that is easy to use. It assists a person considering the use of a human operator model by recommending appropriate tools or modeling environments for the problem in question. HOMER is not a design tool, per se, instead it finds the necessary tools/models to accomplish a specific task.

Point(s) of Contact:
POC: Mr. Ron Laughery
Phone: 303-442-6947 x112
E-mail: rlaughery@maad.com

POC: Dr. Sandy Hart
E-mail: shart@mail.arc.nasa.gov

## HOS (Human Operator Simulator) V

HOS V is a computer simulation tool for modeling the effects of individual or crew performance on system performance. It combines the most viable features of its parent products, Micro Saint and HOS IV. Discrete event simulation is combined with micromodels of human performance. HOS V may be used to model individual or crew performance in a wide variety of systems. It may be used to evaluate various design or redesign alternatives prior to prototyping or implementation. The output of HOS V can be used in the evaluation of person-machine interfaces modeled in terms of time, error and resource utilization. Design alternatives may be compared.

Point(s) of Contact:
POC: Dr. Laurel Allender
Phone: 410-278-6233
E-mail: lallende@arl.mil

## HT-1166 (SHIPSHAPE Hypertext Tool for ASTM-F-1166)

HT-1166 evolved from a demonstrated need to quickly locate and extract specific items of information from ASTM-F-1166, "Standard Practice for Human Engineering Design for Maritime Systems, Equipment and Facilities." It may be used in design documentation, derivation of test and evaluation criteria or any other point in the design process that requires referral to ASTM-F-1166. The objective of the tool is to assist an analyst in quickly and accurately identifying and accessing required sections or criteria of ASTM-1166. There are six main parts to HT-1166: 1) Index Screen, 2) Context Screen, 3) Text Screen, 4) Figures, 5) Tables and 6) Notes. The Index Screen contains two methods for accessing the content of ASTM-1166 - an index and a table of contents. The index contains every word in ASTM-1166 in alphabetical order with the number of occurrences of the word next to it. The Table of Contents is a duplicate of the Table of Contents contained in ASTM-1166. The Table of Contents is scrollable and any item can be selected to display the corresponding section of ASTM-1166.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

## HT-1472 (IDEA Hypertext Tool for MIL-STD-1472)

HT-1472 evolved from a demonstrated need to quickly locate and extract specific items of information from MIL-STD-1472, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities." The objective of the tool is to assist an analyst in quickly and accurately identifying and accessing required sections or criteria of MIL-STD-1472. There are six main parts to HT-1472: 1) Index Screen, 2) Context Screen, 3) Text Screen, 4) Figures, 5) Tables and 6) Notes. The Index Screen contains two methods for accessing the content of MIL-STD-1472 - an index and a table of contents. The index contains every word in MIL-STD-1472 in alphabetical order with the number of occurrences of the word next to it. The Table of Contents is a duplicate of the Table of Contents contained in MIL-STD-1472. The Table of Contents is scrollable and any item can be selected to display the corresponding section of MIL-STD-1472.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

## Human Scale

Human Scale is a very simple tool that was designed for Human Factors Engineers. It is a series of templates of anthropometric data for the 5th-90th percentile population. Human Scale was originally designed to aid Human engineers in evaluating their designs. It analyzes hand wheels to determine reach and vision. The user manually takes viewing numbers that this tool selects and compares them to a drawing to see if they fit.

Point(s) of Contact:
None

## I-CAN (IDEA/SHIPSHAPE Comparability Analysis) Tool

I-CAN was developed to aid Combat Developers in influencing system design by introducing Manpower, Personnel and Training constraints and guidelines in the early developmental phases of the acquisition process. The primary objectives of I-CAN involve establishing operator task constraints as a basis for system development, identifying predecessor or reference system high drivers and limiting or eliminating high drivers in the developing system by addressing MPT issues early in the planning and decision-making process. I-CAN products can provide alternative materiel decisions and can influence design and product supportability throughout the HFE/MANPRINT process.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/FrameDocs/icon.html

**iGEN (Cognition as a Network of Tasks/Generator of Interface Agents)**

The name of this tool has been changed to iGEN; it was formerly COGNET/GINA. iGEN supports the human simulation step in the design process. The GINA Workbench is a C++ implementation of COGNET. This tool can represent differing levels of abstraction, from higher level cognitive functions to low level (e.g., keystroke) data. Perceptual performance is described rather than modeled. Inputs include perceptual events with timing information, expert knowledge on task performance and knowledge requirements. Available outputs are executable models of human cognitive and behavioral task performance. Static outputs are readable descriptions of tasks and knowledge that can be used for other analyses such as training and MMI requirements. Dynamic outputs are timelines of operator actions performed during scenario.

Point(s) of Contact:
POC: CHI Systems
Information: http://www.chiinc.com

**I-HEDGE (IDEA/SHIP-SHAPE Human Factors Engineering Data Guide for Evaluation) Tool**

I-HEDGE is an automated methodology for selecting design test criteria from the Human Factors Engineering Data Guide for Evaluation (HEDGE), Part II of Test Operating Procedure (TOP) 1-2-610. This constitutes Step 6.2 of the TOP 1-2-610 "Steps in Preparation for an HFE Test." I-HEDGE is a FilemakerPro template and user-interface, which aids in the selection, evaluation and hard-copy production of HEDGE Design Checklists. Twenty-two separate checklists are available in I-HEDGE. I-HEDGE can print standard format hard copy of the tailored design checklists for use in a normal, manual manner, or it can be used as an electronic checklist itself during HFE Test and Evaluation. I-HEDGE permits rapid and efficient selection and tailoring of design checklists and prints them in TECOM standard format. In addition, I-HEDGE provides the capabilities of a powerful database management system to permit the user to store the results of checklist evaluations and sub-select, sort and produce reports based on all fields.

Point(s) of Contact:

POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/FrameDocs/ihedge.html

**IMAGE (Integrated Mission Analysis and Scenario Generation)**

IMAGE may be used to support the identification of functions and generation of functional flow block diagrams. Inputs required are ship/system missions and mission requirements, as well as top level functions (BCS, MNS, ORD). As output, IMAGE produces a description of mission scenarios, functional flow- block diagrams and a database of function requirements.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

**IMPACT (Integrated Manpower Analysis and Conceptualization Tool)**

IMPACT can be used to apply knowledge-based system technology to the ship reduced manning effort. The user inputs the front-end mission and function allocation model and results of workload assessment simulations and IMPACT outputs manning impact and cost assessments of alternative concepts and configurations.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

**IMPRINT (Improved Performance Research Integration Tool)**

Comprises HARDMAN III enabling system requirements development, and manpower, personnel and training constraints on system throughout the product life-cycle. The tool is used to assess the impact of system design and manning options on soldier workload and system performance in combat. The tool adheres to an iterative process to determine the best allocation of tasks and the optimum level of automation to handle workload.

Point(s) of Contact:
Information: http://www.maad.com
http://www.arl.mil/ARL-Directorates/HRED/imb/imprint/imprint.htm

## INDI (Integrated Non-Development Items)

INDI can be used to identify HSI requirements and criteria associated with the selection of non-development items. INDI helps the user in the analysis of market input and provides for the application of a COTS/MOTS HSI checklist.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

## INJURY 5.0

INJURY 5.0 is a blast, overpressure predictive injury model that will be used to predict combat survivability of soldiers, give guidance for firing restrictions during training and aid in the development and procurement of safer weapon systems. It will contain a Health Hazard Assessment Methodology that allows a precise estimate of the hazard in a given blast environment (prediction of probability of injury at any confidence level) and a basis to evaluate model predictions in prospective tests.

Point(s) of Contact:
POC: Major Gregory Argyros
Phone: 301-295-2755

## IPME (Integrated Performance Modeling Environment)

IPME is an integrated environment of models intended to help the human factors practitioner analyze human system performance. IPME provides a more realistic representation of humans in complex environments, interoperability with other model components and external simulations, and enhanced usability through a user friendly graphical user interface. IPME is based on the Micro Saint simulation engine with the Human Operator Simulator (HOS) extensions. The MS HOS simulation engine offers a discrete event Monte Carlo simulation engine with an easy to use GUI, a mechanism to define a work space associated with a task network, built-in micro models of human behavior and a simplified modeling of task failures. IPME contains a simple socket protocol to allow passing variables information from external applications. IPME output may be used in queuing analysis, decisions on operators in complex situations, task failure and hierarchical representation of tasks.

Point(s) of Contact:
Phone: 303-442-6947
E-mail: ipme@maad.com
Information: http://www.maad.com/ipme

## I-SHADE (IDEA/SHIPSHAPE Safety Hazard Analyzer, Developer, and Evaluator) Tool

I-SHADE is an automated methodology for establishing a single, closed-loop hazard tracking system and maintaining a centralized "Hazard Log," as required in Task 105 of MIL-STD-882B. It goes beyond the basic requirements to provide an analytic tool for identifying tasks and equipment of special safety concern. I-SHADE is a FilemakerPro template and user-interface, which aids in the storage, analysis and retrieval of hazard information. I-SHADE can use the same task taxonomy as the IDEA Task Analysis Tool or an independent taxonomy can be employed. I-SHADE can generate reports on all individual hazards in one-page (summary) or two-page (full) formats, report listings of sub-selected and sorted hazard titles and summary or full reports on sub-selected and sorted hazards.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/Frame Docs/ishade.html

## ITALIC (IDEA/SHIPSHAPE Tradeoff Analysis) Tool

The ITALIC tool will enable the analyst to quickly conduct tradeoffs of alternative candidate concepts and to generate reports of tradeoff results in text or graphic format. ITALIC provides the capability to define the scope and content of the tradeoff. The tool consists of four functional elements: 1) Setup module, 2) Assessment module, 3) Summary module and 4) Plot module. The ITALIC tool is written in Hypercard for the Apple Macintosh computer.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/FrameDocs/italic.html

## I-TASK (IDEA Automated Task Analysis) Tool

The IDEA/SHIPSHAPE Task Analysis (I-TASK) tool, used in the IDEA and SHIPSHAPE tool sets, is based on requirements expressed in MIL-H-46855 and DI-H-7059 (critical task analysis). Task inventory and analysis is performed and reported during development and acquisition of military systems, equipment and facilities to ensure effective man-machine and man-man interface design; to facilitate effective training program development, testing and evaluation; and to provide information for manning and workload studies. A database is established to house the task inventory output and task analysis data. According to MIL-H-46955B, all critical tasks, as well as tasks that may compromise safety or which show promise of improved efficiency, are to be subjected to a task analysis.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/FrameDocs/itask.html

## JOSTE (Joint Operating and Support Technology Evaluation)

JOSTE is designed to forecast O&S costs associated with maturing technology. It is a LCC model that supports trade-off analyses in evaluating the affordability of new or existing systems in any acquisition phase with emphasis on Operating and Support costs. It will perform LCC and O&S computations and possesses a unique capability to quantify technology applications for emerging technologies in terms of maturity and projected costs. It analyzes and provides information concerning annual costs, system sensitivity, total LCC, and detailed subsystem costs. It also provides CRAIG and CORE formatted reports and comparative analyses.

Point(s) of Contact:
None

## KOALAS (Knowledgeable Operator Analysis-Linked Advisory System)

The KOALAS Decision Process Taxonomy is a unique, theory-based Human Factors Engineering requirements analysis and test planning tool and an architecture for tactical decision support. Inputs required for use are scenario descriptions, tactics, sensors, weapons and vehicle performance data. The KOALAS approach is unique in that it allows individuals to input their own hypotheses into the decision-making process. This allows the human factors analyst to evaluate tradeoffs among tactics, systems performance and human operators performing interpretation, decision-making and communications

tasks. Output is used as requirements analysis for crew sizing for tactical aircraft and for test planning.

Point(s) of Contact:
POC: CDR Micheline Eyraud
Phone: 703-604-2080 x6319
E-mail: eyraudmy.ntrprs@navair.navy.mil

## LCOM (Logistics Composite Model)

LCOM is a Monte Carlo simulation model, written in SIMSCRIPT II.5, used to model the interaction of maintenance, operations and supply functions for any type of system (mechanical, electronic or weapon system). The model can and has been used to develop and analyze baseline comparison systems, perform tradeoffs and evaluations, and evaluate the interaction of Integrated Logistics Support elements.

Point(s) of Contact:
POC: Richard Cronk
Phone: 513-255-8060
E-mail: cronkra@xrease.wpafb.af.mil

POC: Alan Wallace
Phone: 513-255-8060
E-mail: wallacaj@xrease.wpafb.af.mil

## LMT (Logistics Modeling Tool)

In the crewstation of an airplane, the ability of the pilot to unambiguously perceive rapidly changing information both internal and external to the crewstation is critical. To assess the impact of crewstation design decisions on the pilot's ability to perceive information, the designer needs a means of evaluating the trade-offs that result from different design parameters. The Legibility Modeling Tool provides the designer with a analysis tool for assessing these trade-offs. It combines the technologies of computer graphics and human performance modeling into a computer-based, interactive design tool. Through a simple interactive interface, a designer can manipulate design parameters such as the geometry of the cockpit, environmental factors such as ambient lighting, pilot parameters such as point of regard and adaptation state, and equipment parameters such as the location of displays, their size and the contrast of displayed symbology. The Legibility Modeling Tool provides an end-to-end analysis that answers questions such as, "Will the pilot be able to read a prospective display?"

Point(s) of Contact:
POC: Michael Prevost
Phone: 415-604-1330
E-mail: prevost@eos.arc.nasa.gov
Information: http://ccf.arc.nasa.gov/af/aff/midas/www/Legibility.html

**MacSHAPA**

MacSHAPA is a Macintosh®-based software environment that supports observational data analysis, including the analysis of video. Qualitative and quantitative analysis activities are both supported. Users may simply browse video records, making unstructured comments that can later be searched or used to access interesting parts of the video. Alternatively, users may develop coding schemes within MacSHAPA, tag video records or data files with these codes, and then use statistical routines to analyze the data once fully encoded. MacSHAPA can be used for observational studies in cognitive engineering, cognitive modeling, human-computer interaction, developmental psychology, group decision making and teamwork, computer-supported collaborative work (CSCW) environments, analysis of emergency response and in many other domains.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/macshapa.htm

**MDHMS (McDonnell Douglas Human Modeling System)**

The McDonnell Douglas Human Modeling System (MDHMS) enables electronic simulation/demonstration of assembly, operations and maintenance early in the design process using 3-D animated human manikin with articulated limbs and inverse kinematics. MDHMS is a menu-driven, interactive computer program used to define design requirements and aid in design evaluation. MDHMS allows the user to reduce the need for physical development fixtures by performing evaluations electronically and reduce design costs, enabling the design team to more rapidly prototype and test a design. It also helps the user avoid costly design "fixes" later in the program by considering human factors requirements early in the design and improves customer communications at every step of product development by using animated graphics.

Point(s) of Contact:
POC: Dr. Michael Biferno

Phone: 310-593-7094
E-mail: biferno@c17m.mdc.com

**Micro Saint (and Action View)**

Micro Saint is a discrete-event task network modeling tool. Micro Saint can be used to analyze and improve any system that can be described by a flow diagram. Micro Saint executes a discrete event simulation model. This model uses the stochastic branching logic, task interactions and performance estimates to generate results that predict the range of system outputs. This analysis is difficult and time consuming to do by hand, due to the stochastic nature of most systems. Micro Saint's output can be portrayed in tabular or graphic form including: line graphs, scatter graphs, step charts and frequency distributions. Output is collected in standard ASCII format, and data can be imported or exported directly to or from popular spreadsheet or statistical packages. Action View, an Iconic Animation tool, allows the user to create a customized animation scene.

Point(s) of Contact:
Phone: 303-442-6947
E-mail: sales@maad.com
Information: http://www.maad.com/msaint.htm

**MIDAS (Man-Machine Integration Design and Analysis Systems)**

MIDAS is an integrated suite of software components to aid analysts in applying human factors principles and human performance models to the design of complex human-machine systems. MIDAS is intended to be used at the early stages of conceptual design as an environment wherein designers can use computational representations of the crew station and operator, instead of hardware simulators and man-in-the-loop studies, to discover problems and ask questions regarding the projected operator tasks, equipment and environment for advanced vehicles. The goal of the program is to develop an engineering environment that contains tools and models to assist design engineers in the conceptual phase of rotorcraft crewstation development and to anticipate crew training requirements. The MIDAS test bed serves to aid designers with predictive data on operability, levels of automation and function allocation issues for human machine systems and to support further research on human performance models. Use of the mission simulation tool requires that the user specify the tasks or activities to be performed by the simulated operators as well as the functional and physical characteristics of the cockpit equipment. Operator characteristics, such as size and selected cognitive characteristics, may also be specified. The

MIDAS simulation system is based on models of simulated operators interacting with models of cockpit equipment, vehicles, terrain and other scenario objects. The actual mission scenario that results from running a simulated mission may be a combination of planned and contingent activities. The symbolic operator models include models of vision, attention and perception. A task loading model computes resource loading and conflicts.

Point(s) of Contact:
POC: Sherman Tyler
E-mail: MIDAS@qmgate.arc.nasa.gov
Information: http://ccf.arc.nasa.gov/af/aff/midas/www/Core_Midas.html

**MPT DSS (Manpower, Personnel and Training in Acquisition Decision Support System)**

The MPT DSS is an early weapon system acquisition analysis tool. It is designed to aid decision makers in the selection of MPT support alternatives of a weapon system by examining life-cycle cost estimations and human resource requirements. MPT DSS provides a user-friendly environment which guides users through the process of: obtaining and extracting key MPT data from databases, conducting critical manpower and training analyses, developing an audit trail to document the analysis process and conducting tradeoff and sensitivity analyses to assess the impact of MPT and system alternatives.

Point(s) of Contact:
POC: Capt Richard Jenkins, MPT DSS Program Manager
Phone: 210-536-3794
E-mail: jenkinsr@alhrm.brooks.af.mil

POC: 2d Lt Eric Herbek, MPT DSS IV&V Project Officer
Phone: 210-536-3794
E-mail: herbek@alhrm.brooks.af.mil

POC: Dr. Larry O'Brien, MPT DSS Program Manager, Dynamics Research Corporation
Phone: 508-475-9090
E-mail: lobrien@s1.drc.com

Information: http://www.brooks.af.mil/HSC/products/doc42.html

**NASA-TLX (NASA Task Load Index)**

NASA-TLX is a subjective workload assessment tool. NASA-TLX allows users to perform subjective workload assessments on operator(s) working with various human-machine systems. NASA-TLX is a multi-dimensional rating procedure that derives an overall workload score based on a weighted average of ratings on six subscales. These subscales include Mental Demands, Physical Demands, Temporal Demands, Own Performance, Effort and Frustration. It can be used to assess workload in various human-machine environments such as aircraft cockpits; command, control, and communication (C3) workstations; supervisory and process control environments; simulations and laboratory tests. NASA-TLX is a fully automated version of its predecessor pencil and paper version. Data collection may be performed through the keyboard or mouse. The use of source-of-load weighting is optional, but necessary to produce a weighted workload score. For a full review of the features and functions of NASA-TLX, please consult the users' manual.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/tlx/tlx.htm

**Network(c) (IDEA/SHIPSHAPE Task Sequencing) Tool**

Network(c) is used in the IDEA and SHIPSHAPE tool sets. Human Systems Integration (HSI) initiatives often require the representation of a man-machine system as a network of tasks performed by operators or maintainers. Operational sequence diagrams and task flow charts, used in connection with task analysis, provide examples of the graphic representation of a network of tasks. In these graphic approaches, tasks are represented as nodes (or boxes), and branches between tasks (arrows) indicate the sequence in which tasks are performed. Network enables the HSI analyst to quickly develop a functional model of a system and depict the model in graphic format. The graphic model provides the capability to identify required functions and tasks and to determine the temporal, spatial, causal and cooperational relationships among functions and tasks in a manner that is quickly achieved and easily modified and updated.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com/FrameDocs/network.html

**OASYS (Operability Assessment System)**

OASYS is a tool box which analysts can use to investigate man/system function tradeoffs, automation/crew function composition tradeoffs and human/computer integration issues (collectively termed operability issues) during system development. The tool box contains task analysis, rapid prototyping and system simulation tools. OASYS provides designers the ability to begin assessing system operability early in the design process. OASYS supports designers in determining the right mix of automation, allocation of function and crew sizing, while reducing usability problems. Using OASYS, an analyst creates a soft prototype of the system under consideration. The soft prototype is a physical mock-up of the system where the system functionality is emulated. The analyst defines representative scenarios under which the system can be used. The design is then analyzed using human in-the-loop simulation technology. Operational variables can be used to compare performance differences between different operators, different operator models and different designs.

Point(s) of Contact:
POC: Capt. Kurt Bolin
Phone: 513-225-9662
E-mail: kbolin@alhrg.wpafb.af.mil

**Observer**

The Observer is a tool for the collection, analysis, presentation and management of observational data. It can be used to record activities, postures, movements, positions, facial expressions, social interactions or any other aspect of human or animal behavior. Data may be entered directly into a PC or handheld computer, or events can be coded from video tape or digital media file. Analysis reports are available instantly and provide both objective and quantitative data for direct conclusions or further research.

Point(s) of Contact:
Phone: 703-404-5506 or 800-355-9541
E-mail: info@noldus.com
Information: http://www.noldus.com/products/observer/obs index.htm

**ORCA (Operational Requirements-Based Casualty Assessment System) and ComputerMan**

The ORCA model enables the user to assess the anti-personnel effects associated with various munitions-produced damage mechanisms. Given a specified level of hit or exposure, ORCA calculates anatomical damage and the effect on individual performance of exposure to kinetic energy (fragment),

thermal, chemical, directed-energy (laser), blast and accelerative loading threats. The effect of a computed injury is characterized by the predicted impairment of each of 24 human elemental capabilities (e.g., vision, cognition and physical strength). Post-injury capability is then compared to capability requirements associated with the individual's military job, task or mission to determine whether he/she is an operational casualty. ComputerMan and ORCA operate using an identical anatomical model. ComputerMan, however, deals only with penetrating injuries, and its output is limited to levels of performance degradation and probabilities of survival.

Point(s) of Contact:
POC: David N. Neades
Phone: 410-278-6335
E-mail: dave@arl.mil
Information: (ComputerMan) http://web.arl.mil/software/ComputerMan

**OWLKNEST (Operator Workload Knowledge-Based Expert System Technology)**

OWLKNEST is a microcomputer-based methodology that guides selection of the appropriate techniques for assessing Operator Workload (OWL). The output of OWLKNEST is a list of OWL techniques with a ranking of high, average or low applicability. The rankings are based on cumulative probabilities that the system builds with each question answered by the user. The user also can obtain one-page descriptions of the recommended techniques including implementation requirements, references and points-of-contact.

Point(s) of Contact:
POC: Dr. Richard Christ
Phone: 913-684-4933

**PATS (Psychophysiological Assessment Test System)**

PATS provides a comprehensive test system for the measurement of psychophysiological data. This micro-computer-based system supports psychophysiological research in a wide variety of applications ranging from operational environments with "real-world" tasks to laboratory environments with standardized tests. PATS is designed to meet a number of requirements, including multi-functionality, in terms of testing environments and research applications, financial economy and usability. The user-friendly interface is designed especially for the non-psychophysiologist. To meet the widest possible range of test environments, PATS is a single system capable of

simultaneously presenting stimuli, collecting performance and physiological data, and reducing and analyzing these data. The user can monitor and evaluate any variety of physiological responses, including electrocardiograms (ECG), electroencephalograms (EEG), evoked potentials (EPs), electrooculograms (EOG), electromyograms (EMG) and respiration. PATS also provides data reduction mechanisms for reducing data; performing spectral analysis and R-wave detection; determining interbeat intervals of cardiac data and summary parameters of eyeblinks; and generating tables for submission into PATS internal statistics package.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/pats.htm

**PRICE HL (Programmed Review of Information for Costing and Evaluation for Hardware Life cycle cost)**

PRICE HL estimates the operation and support costs for supporting hardware during the operational phase of its life cycle. It was initially developed in the early 1970's and is updated by Al Calvo of TASC, Incorporated. It is now updated by PRICE Systems on a regular basis. It applies traditional life cycle costing relationships. PRICE HL determines the costs of development, production, and support and total program for equipment, support equipment, supply and supply administration, and manpower and contractor support.

Point(s) of Contact:
None

**RECAP**

RECAP is a top-level requirements analysis tool that supports the Requirements Analysis tasks by capturing requirements from documents and assessing their syntax for correctness, ambiguity, or completeness. It will not assess or derive requirements resulting from engineering analysis, but provides the mechanisms for determining if the requirements database is sufficient to avoid costly misinterpretation of specified requirements.

Point(s) of Contact:
None

**ROMAN (Roles of Humans & Automation)**

Roman is a function allocation tool capable of producing alternative approaches for the role of man vs. automation for selected scenarios. Output from both IMAGE and I-CAN is used as input. Roman uses human-centered strategies and approaches to develop design requirements for human-machine interfaces to support human-automation interaction, cooperation, coordination and collaboration.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225
Information: http://carlow.com

## ROPER (Role of the Person) Function Allocation Tool

The IDEA ROPER tool is intended to help guide the preliminary allocation of functions. It allows direct allocation of functions to men or machines by a human engineering analyst without consideration of the allocation recommendation logic contained in the program. It also allows an analyst to request a consultation to aid in generating a preliminary allocation decision. When asked, the system poses up to 30 questions to the analyst regarding the nature of the function and the implications of the function on overall system effectiveness. The system renders an allocation recommendation (which may be accepted or rejected by the analyst) and a preliminary role of the human.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225

## SAFEWORK(tm)

SAFEWORK(tm) is a software tool that creates virtual humans of various percentiles to study fit and accessibility in a workstation. Numerous forms of analysis can be done including postural analysis, reach and access studies along with a sophisticated vision module for sight analysis. Animation allows users to simulate tasks and optimize the work involved within a virtual work environment. Acting as a Virtual Mockup, SAFEWORK(tm) allows the user to analyze the mannequin's ability to function within the imported CAD design and perform the closest form of customization for all future users of the final design.

Point(s) of Contact:
POC: Robert Carrier

Phone: 514-931-3000
E-mail: robert@safework.com
Information: http://www.safework.com

**SHIP-SHAPE (Ship System Human Systems Integration for Affordability and Performance Engineering)**

SHIP-SHAPE is a set of automated processes, tools, and databases developed specifically to enable HSI analysts in the Navy and in the commercial ship building and maritime system arena to meet HSI requirements as contained in the DoD 5000 series, SECNAV Instruction 5000.2B, Naval Sea Systems Command Instruction 3900.8, ASTM-1166 and ASTM-1337. The guiding principle behind the design of the SHIP-SHAPE software is that the HSI analyst should have at his or her fingertips all of the guidance, instructions, processes, procedures, methods, tools, and data needed to conduct a timely and complete HSI effort. The elements of the SHIP-SHAPE system are: the HFE process for ships, automated HFE tools, and data bases of HSI standards and results of HSI analyses for ship systems.

Point(s) of Contact:
None

**SIMWAM(c) (Simulation for Workload Assessment and Modeling) Tool**

SIMWAM(c) is used in the IDEA and SHIPSHAPE tool sets. SIMWAM(c) is a microcomputer-based task network modeling technique for assessment of operator/crew workloads, personnel performance problems, performance effectiveness and system/process throughput times in man-machine systems. It allows the analysts to create a database of task requirements, execute the task network, obtain performance data, and modify the network or tasks in order to evaluate alternate concepts for manning, allocation of tasks to operators or interface design. Task definitions, flow relationships, and task parameters are based on system documentation, information from subject matter experts or other appropriate sources. SIMWAM(c) can also execute a network model previously defined using NETWORK(c). The interactive nature of SIMWAM(c) allows the analyst to evaluate alternate system design or modification concepts involving manpower reduction, cross-training, automation, task modification or function allocation.

Point(s) of Contact:
POC: Carlow International, Inc.
Phone: 703-698-6225

Information: http://carlow.com/FrameDocs/simwam.html

## SNAP (Simulation Network Analysis Project)

SNAP can be used for determinative evaluation of networked simulation system accuracy and latency. SNAP was started to quantitatively measure simulation system accuracy and network latency. Simulation latency has been identified as a problem area when high-fidelity simulations are attempted. Training tasks, such as formation flying and aerial refueling, are nearly impossible with some of the latencies found in today's simulation systems. The SNAP project was designed to not only identify delays in simulation systems (such as pilot input to visual roll delay), but also to gather latency data on long-haul networks. SNAP has been involved in several major simulation network exercises and has proven itself as a credible simulation system and network research tool.

Point(s) of Contact:
POC: Lt David J Barnhart
Phone: 513-255-4690
E-mail: barnhadj@b045mail.wpafb.af.mil
Information: http://www.wl.wpafb.af.mil/flight/fed/figd/figd.html

## SORD (Systematic Organizational Design)

The SORD methodology is a user-oriented, computer-assisted tool that addresses three basic components of the current Unit Reference Sheet (URS) development process. One component is ensuring that the unit design process is driven by the unit's mission. The second component is designing a structured unit with its required material and personnel assets. The third component is verifying that the designed unit does have the capabilities required to accomplish its mission. The input necessary for SORD consists of data from an operational concept and an Operational and Organizational plan. The SORD creates a standard structure in which a combat developer can design an Army unit. The output of SORD is a completed URS that follows a format generated by the methodology. It provides sufficient detail in personnel and equipment requirements to permit it to be used in subsequent Army studies and cost analyses. Variations of the URS are developed by changing any of several variables. When the URS is completed, the user will have a complete audit trail so that reconstruction of each step is possible and the rationale for each step is available. SORD will permit the rapid development of alternative conceptual designs.

Point(s) of Contact:

POC: Dr. Richard Christ
Phone: 913-684-4933
E-mail: christ@ari.fed.us

**STRES (AGARD Standardized Tests for Research with Environmental Stressors) Battery**

The STRES Battery is comprised of seven tests, which include: Reaction Time; Mathematical Processing; Memory Search; Spatial Processing; Unstable Tracking; Grammatical Reasoning; and Dual Task (unstable tracking with concurrent memory search). It can be used to evaluate the effects of environmental stressors or to assess the information processing capabilities of humans. To evaluate stressors, emphasis is placed upon comparing performance of subjects under controlled conditions to that under unfavorable conditions, such as sleep deprivation and fatigue, monotony and boredom, illnesses' toxic fumes, hypoxia, temperature extremes, and alcohol and other drugs. In the assessment of information processing abilities, interest may lie in differences between individuals or groups, such as gender, age or intelligence. Researchers, designers and engineers can use the results of the research studies to evaluate the impact that stressful environments have on human performance in human-machine systems.

Point(s) of Contact:
POC: Chris Sharbaugh
Phone: 513-255-4842
E-mail: cseriac@falcon.aamrl.wpafb.af.mil

**SWAT (Subjective Workload Assessment Technique)**

SWAT provides an easily administered subjective scaling method to be used in the cockpit or other crewstations to quantify the workload associated with various activities. SWAT postulates a multidimensional model of workload comprising three, three-point dimensions or factors: 1) time load, 2) mental effort load and 3) psychological stress load. The method involves a two-step procedure. In the first step, the scale development phase, hypothetical activities are rank-ordered according to perceived workload. Each activity is specified in terms of a particular distribution of load across the three dimensions. These data are transformed, by means of conjoint measurement, into an interval scale of workload ranging from 0 to 100. In the second step, the event scoring phase, an activity or event is rated by assigning a value of 1 to 3 on each of the three dimensions. The scale value associated with this combination (obtained from the scale development phase) is then assigned as the workload value for that activity.

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/swat.htm

## TAWL (Task Analysis Workload)

TAWL uses task analysis information to develop operator workload prediction models, i.e., estimates of the workload associated with the cognitive, psychomotor and sensory components of individual and concurrent operator tasks. TAWL can be used with a variety of databases, such as the TAWL Operation Simulation System (TOSS). (TOSS is a database for aircraft which includes the UH60, AH64, CH47, MH47, and MH60.) With the TOSS database, TAWL can be used to determine the optimal system design or configuration for a mission based on workload considerations, develop models of two or more systems to identify the systems or configurations with higher workload and evaluate a system's manning and training requirements. The TAWL output consists of workload metrics (number of overload conditions, number of component overloads and overload density) for segments and crewmembers, summary of subsystem overloads and task listings. Analyses can be made for up to four crewmembers. The output from TAWL can be used to identify mission time periods, components, crewmembers and subsystems with high workload. This information can be used in the system design process, e.g., to make adjustments in the distribution of tasks during the mission to equalize workload over time and over crewmembers or to make adjustments in the nature of tasks.

Point(s) of Contact:
POC: Dennis Wightman
Phone: 334-255-2834
E-mail: wightman@rwaru-emh1.army.mil

## TEMAP (User-Assisted Test and Evaluation Methodology Assistant Program)

TEMAP is an expert system/software tool that helps guide systems' experimentation projects by cross-referencing various stages of the test and evaluation (T&E) cycle (i.e., planning/scheduling, test execution and test analysis/interpretation) with potential problem-solving methods, techniques, procedures and guidelines (checklists).

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/temap.htm

## Transom Jack

Transom Jack is a real-time visual simulation solution that enables you to create virtual environments by importing CAD data or creating objects, populating your environment with biomechanically accurate human figures, assigning tasks to these virtual humans and obtaining valuable information about their behavior. Transom Jack allows you to visualize the feasibility of certain tasks, assess the risk of low back injuries for specific tasks, analyze energy expenditure, evaluate the comfort of postures, obtain information on strength capability and generate "possible" and "comfortable" reach envelopes.

Point(s) of Contact:
Information: http://www.transom.com/Public/transomjack.html

## TSIInterchange

TSIInterchange acts as a central repository for all engineering and project management activity. It provides a project/engineering level framework for assessing design status, supports coordination/notification of changes to design artifacts, permits shared access to design artifacts, and gathers metrics. TSIInterchange is a very complex infrastructure, which hides its complexity from the users by providing an easy-to-use GUI. Tool plug-ins may be generated to integrate tools into the repository with little effort (depending on the complexity of the tools being integrated) and a schema builder is provided to extend the schema to add new object definitions, or object attributes/relationships within the existing schema.

Point(s) of Contact:
Information: http://www.tridsys.com/

## USARIEM

Heat Strain Model, P2NBC2 Heat Strain Decision Aid Implementation - The USARIEM Heat Strain Model is a menu-driven tool designed to help predict and enhance soldier performance and endurance. Predicted values are based on user-specified environmental conditions, work level, acclimatization status and clothing types. Outputs include optimal work/rest cycle limits, maximum safe work time, hourly drinking water needs, equilibrium core temperature and probability of casualty. Output may be used for evaluation of the effects of various clothing types on military task performance, evaluation

of weather effects on task performance and heat injury risk and evaluation of the effects of soldier attributes and acclimatization.

Point(s) of Contact:
POC: William Matthew
Phone: 508-651-5140
E-mail: matthew@natick-ilcn.army.mil

**WC FIELDE (Workload Consultant for Field Evaluations)**

WC FIELDE is a microprocessor-based system designed to assist users in selecting appropriate workload assessment procedures. It suggests measures in descending order of utility based on the user's answers to a variety of questions concerning the specific application. The factors that it takes into account include the focus of the research question, the research environment and the facilities that are available. The recommended workload assessment techniques are chosen from a large pool of currently available techniques, including primary tasks, secondary tasks (e.g., tracking, memory, etc.), physiological measures (e.g., heart rate, heart rate variability, etc.) and subjective measures (e.g., SWAT, NASA-TLX, etc.).

Point(s) of Contact:
E-mail: cseriac@cpo.al.wpafb.mil
Information: http://cseriac.flight.wpafb.af.mil/products/WCFIELDE.htm

**WinCrew**

WinCrew can be used to predict operator workload for a crew given a design concept. It provides users with a method to assign workload estimates to tasks that crew members are performing. It also has the ability to model and predict the effects of that workload on crew and system performance. What separates WinCrew from other workload models is this direct link between task-induced workload and the effect on system performance. WinCrew enables the user to predict how the human will dynamically alter his behavior when he or she encounters high workload situations. As a function of high workload, WinCrew can simulate dynamic allocation of tasks between humans or machines, dropping tasks based on task priority, and task time and accuracy degradation.

Point(s) of Contact:
Phone: 303-442-6947
E-mail: wincrew@maad.com
Information: http://www.maad.com/WinCrewSupport/index.html